STAT303 Secs 509–511
Spring 2002
Exam #3
Form A

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1. **Don't EVEN open this until you are told to do so.**
2. There are 20 multiple-choice questions on this exam, each worth 5 points. There is partial credit. Please mark your answers **clearly** on the scantron. Multiple marks will be counted wrong.
3. You will have 60 minutes to finish this exam.
4. If you are caught cheating or helping someone to cheat on this exam, you both will receive a grade of **zero** on the exam. You must work alone.
5. This exam is worth 100 points, and will constitute 20% of your final grade.
6. Good luck!

   Also, PRINT your name at the top of this exam and include your Thursday section and computer number. You will get your scantron and exam back.

1. Given the 90, 95 and 99% confidence intervals for $\pi_1 - \pi_2$: (0.12,0.84),(0.05,0.91),(-0.08,1.04), what is the correct range of the p-value for testing $H_0 : \pi_1 = \pi_2$ vs. $H_A : \pi_1 \neq \pi_2$?

   A. p-value > 0.10
   B. $0.10 > p$-value > 0.05
   C. $0.05 > p$-value > 0.01
   D. p-value< 0.01
   E. You need a test statistic value to determine the p-value

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2. Researchers feel that due to differences in maturity healthy children have a naturally higher cholesterol level than healthy adults whose average is about 180. Which is the best set of hypotheses to use to determine if they are correct? The subscript '1' denotes 'children', and '2' denotes 'adults'.

   A. $H_0 : \mu_1 = 180$ vs. $H_A : \mu_1 \neq 180$
   B. $H_0 : \mu_1 \leq 180$ vs. $H_A : \mu_1 > 180$
   C. $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 \neq \mu_2$
   D. $H_0 : \mu_1 \leq \mu_2$ vs. $H_A : \mu_1 > \mu_2$
   E. H_0 : age has no effect on cholesterol levels vs. H_A : age has a significant effect on cholesterol levels

3. Which of the following would be the best way to collect the data on the children for the test above?

   A. get a random sample of children, allow them to eat whatever they want, then find the cholesterol level of each
   B. find a random sample of adults with cholesterol levels about 180 and find the cholesterol level of their children
   C. get a random sample of adults and their children and take the difference in their cholesterol levels
   D. get a random sample of adults and children (not necessarily theirs since we want to be able to generalize to the whole population) and find the cholesterol level of all
   E. get a random sample of children with cholesterol levels about 180

4. Which of the following would be a consequence of a Type II error in the scenario above? Assume if children are NOT supposed to have a higher cholesterol, then a child with a level above 180, the adults' average, would be put on a restricted diet.

   A. Children were put on a restricted diet since they found their cholesterol levels were too high.
   B. Children were given the same restrictions as adults who need to lower their levels even though the children's cholesterol levels are supposed to be higher than adults'.
   C. Children were allowed to eat whatever they want (no restrictions) even though their cholesterol levels should be no higher than that of adults.
   D. Children were forced to conform to their parents diets even though their can tolerate high cholesterol foods.
   E. Children were given high cholesterol diets to increase their levels.

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5. A university professor teaches two sections of the exact same course. Recently, he gave the same 30 point quiz to both sections. What type of test should he run to see if the two sections are doing about the same?

   A. You can't prove $H_0 : \mu_1 = \mu_2$, the section averages are the same, so he can't test this claim.
   B. large 2 sample t-test (an approximate z-test) since there were 30 questions on both exams
   C. a paired t-test, pairing the students by class standing, i.e., the best in one section with the best in the other
   D. a pooled t-test since the standard deviations of the two sections would be the same and the pooled t-test has more power
   E. As long as there are at least 30 students in each section, he could do a 2 sample or pooled t-test depending on how close the standard deviations were.

6. What is the advantage of using a paired t-test (Case 10) over either 2 sample t-tests (Cases 8 or 9)?

   A. You only need half as many observations (smaller sample size).
   B. You have more power (easier to detect a difference).
   C. You have more degrees of freedom (less conservative test).
   D. All of the above are advantages to the paired t-test.
   E. Exactly two of the above are advantages to the paired t-test.

7. Twelve people were given 10 minutes to memorize a list of 20 nonsense words. They were asked to list as many of the words as possible after 1 hour had passed and then asked again 23 hours later (the next day). The average after 1 hour was 15 words and the average after 1 day was only 13 words. What method should be used to determine whether the average number of words recalled after 1 hour exceeds the average after 1 day?

   A. a one sample t-test comparing the sample average after 1 day with 15 assuming the data is approximately normal
   B. a two sample z-test of a proportions using the percent of words recalled after 1 hour and 1 day assuming the data is approximately normal
   C. a paired t-test pairing by the 12 people assuming the data is approximately normal
   D. a pooled t-test since the standard deviations should be about the same assuming the data is approximately normal
   E. a 2 sample t-test since we can't assume anything

8. We want to test whether eating a good breakfast (or lunch if it's an afternoon class) improves the mental performance of students on exams. If we decided to give a sample of 50 students an exam without letting them eat and then the next day giving them a similar exam (but having taken the first exam wouldn't help them on the next one) after they all ate, what type of test procedure we use?

   A. a one sample t-test since we don't know the true standard deviation
   B. a one sample test of proportions using the success rate as the sample proportion
   C. a two sample test of proportions comparing the success rates
   D. a two sample test of mean (t-test) comparing the exam averages
   E. a paired t-test pairing the exam scores by student

9. Which of the following is/are TRUE?

   A. A two-sided pooled t-test has more power than ANOVA F-test for only 2 means.
   B. A paired t-test has more power than either a pooled t-test or a 2 sample t-test.
   C. A one-sided test of hypotheses has more power than a two-sided.
   D. All of the above are true.
   E. Only two of A, B and C are true.

10. We want to test if there is sufficient evidence to say that the percentage of heart disease victims for smokers is different for men and women. How should we gather the data?

    A. take a sufficiently large random sample of men and women, have them smoke for 10 years, and calculate the proportion with heart disease
    B. take two sufficiently large random samples of men and women smokers and calculate the proportion with heart disease
    C. take two sufficiently large random samples of men and women smokers and calculate the time until the onset of heart disease
    D. take two sufficiently large random samples of men and women smokers and calculate the proportion with a family history of heart disease
    E. take two sufficiently large random samples of men and women smokers and force them to stop smoking since it also causes heart disease

11. The purpose of *pairing* in an experiment is to

    A. make the samples independent
    B. increase the degrees of freedom of the t-test
    C. match the observations so that there is less data and therefore less chance of making an error
    D. reduce the variability of the data
    E. reduce the chance of making a Type I error

12. Researchers want to determine if there is a difference in the mean income level of people who are either single, married, divorced or widowed. What type of test should they use assuming they have more than 30 in each group?

    A. a two sample t-test comparing the average for singles vs. the others since you had to be married to be divorced or widowed and you wouldn't need as many people (married, divorced and widowed total more than 30)
    B. a pooled t-test testing the means as in A but assuming the standard deviations are the same
    C. a One-way ANOVA comparing all 4 means
    D. a two sample test of proportions assuming the sample proportions are large enough to use the normal approximation
    E. a χ^2 test of multiple proportions assuming the sample proportions are large enough to use the normal approximation

13. Suppose you are interested in the caloric content of hamburgers. You took a random sample from 3 different chains and calculated the following confidence intervals: Chain 1: (248.9,307.8); Chain 2: (263.5,309.3); Chain 3: (307.1,349.7). Which of the following would be the most appropriate conclusion?

    A. The true mean caloric content for Chain 3 is more than that of Chain 1 or 2.
    B. The true mean caloric content for Chain 3 is more than that of Chain 1 but not Chain 2.
    C. The true mean caloric content is different for all three chains.
    D. The true mean caloric content is possibly the same for all three chains.
    E. We cannot determine any conclusion since we don't have a method for testing three means.

14. Which of the following tests require the data to be normal?

    A. a one sample z-test of a proportion
    B. a one sample t-test of a mean with $n = 50$
    C. a paired t-test for the difference of means with a total of 50 observations
    D. All of the above need the data to be normal.
    E. Only two of the above need the data to be normal.

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                Analysis of Variance
  Source    SS        df      MS       F    Prob > F
-------------------------------------------------------
   Car    1456.5       4    364.1    25.15    0.000
  Error    362.0      25     14.5
-------------------------------------------------------
  Total   1818.5
Confidence Intervals for the 5 Cars
----+---------+---------+---------+---
(----*----)  Acura
 (----*----)  Lotus
          (----*----) Viper
                      (----*----) Porsche
                          (----*----) Ferrari
----+---------+---------+---------+---
 161.0     168.0     175.0     182.0
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15. *Car and Driver* gathered data on the top speeds of five supercars from five different countries—Acura NSX-T from Japan, Ferrari F355 from Italy, Lotus Esprit S4S from England, Porsche 911 Turbo from Germany, and Dodge Viper RT/10 from the U.S. The data represent the top speeds for six runs on each car, using as much distance as necessary without exceeding the engine's redline. There were three runs in each direction on the test facility, to cancel grade or wind effects. According to the information above, is there a difference in the cars' top speeds?

    A. Since the p-value is 0.000, we can conclude that there is a difference in the cars' top speeds.
    B. Since the p-value is 0.000, we can conclude that Ferrari and Porsche are better cars.
    C. Since the p-value is 0.000, we can conclude that Ferrari and Porsche are faster cars.
    D. Since the p-value is 0.000, we can conclude that former WWII Allies in Europe build faster cars.
    E. Since the p-value is 0.000, we can conclude that any of these models will get you a ticket!

16. Which of the following are necessary assumptions for the test above to be valid?

    A. All of the sample means must be equal.
    B. All of the population means must be equal.
    C. All of the sample variances must be equal.
    D. All of the population variances must be equal.
    E. Two of the above are necessary.

17. Which of the following is/are FALSE!!!!!!!!!!!!!?

    A. A significant F-test in a One-way ANOVA table means all of the population means are different.
    B. The name 'One-way Analysis of Variance' is actually misleading because the procedure is really testing means not variances.
    C. A One-way ANOVA F-test compares the variability of the sample means with the averaged variance of samples (the samples are assumed to have equal variances).
    D. A One-way ANOVA F-test has the same assumptions as a pooled t-test.
    E. All of the above are true.

18. When should you use a significance level of 1% instead of 5%?

    A. when you want to keep the chance of making a Type I error low.
    B. when you want to keep the chance of making a Type II error low.
    C. when you want to keep the chance of making a Type II error high.
    D. when you want to keep the power of the test high.
    E. Exactly two of the above are good reasons.

19. Suppose we tested $H_0 : \pi = 0.5$ vs. $H_A : \pi \neq 0.5$ and got a TEST STATISTIC VALUE, $z = 0.06$. What is the conclusion?

    A. Since it's less than 10%, but not 5 or 1%, we reject at the 10% level, but not at the 5 or 1% level.
    B. Since it's less than 10, 5 and 1%, we reject at all 3 levels.
    C. Since it's less than 0.5, we reject at any α level.
    D. Since we're not given a p-value, we can't decide whether to reject or fail to reject.
    E. We fail to reject at any usual α level: 1, 5 or 10%.

20. The lifetime of 60W GE light bulbs are known to follow an exponential (skewed to the right) distribution. GE wants to test its own claim that the average lifetime of its 60W light bulbs is at least 1000 hours, so they test 10 bulbs at random (they don't want to destroy too many) and calculate the mean and standard deviation of their sample. Which type of test should they perform?

    A. Case 1 since they know the true standard deviation of the light bulb lifetimes.
    B. Case 2 since they have a small sample.
    C. A nonparametric test since they have a small sample.
    D. Case 5 since the data is not normal.
    E. Case 9 using the known mean and standard deviation as the second sample statistics.

1C,2D,3C,4B,5E,6B,7C,8E,9E,10B,11D
12C,13D,14C,15A,16D,17A,18A,19E,20C